Stony Brook University
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Doctoral Defense Announcement

Abstract

Some Results on One-Dimensional Models with Broken and Deformed Symmetries

By

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We present analytic results for the ground state properties and entanglement in the Lieb-Liniger model and q-deformed Affleck-Kennedy-Lieb-Tasaki (AKLT) models. The translational invariance of the Lieb-Liniger model is broken by an external harmonic potential in one case and by coarse-grained measurements of particle number in another. Meanwhile, anisotropy is introduced into the AKLT model by generalizing its SU(2) invariant hamiltonian into one that is $SU_q(2)$ invariant.

The Lieb-Liniger model describes a one-dimensional gas of bosons that interact pairwise by a zero-range interaction term. Under longitudinal harmonic confinement, the exact spectrum of the hamiltonian is known only for free and impenetrable bosons. We use a pseudopotential approach and perturbation theory to calculate the ground state energy of this gas near the limit of infinite repulsion.

We further study entanglement in the periodic homogeneous Lieb-Liniger model. When the particle number in a spatial partition of the ground state is measured, entanglement in the resulting state arises only from interparticle interactions. We demonstrate that entanglement in these projected states increases monotonically with the strength of interactions.

Finally, we discuss how anisotropy reduces entanglement in the valence-bond-solid ground state of the q-deformed AKLT model. We propose effective thermal models that describe block entanglement in terms of boundary degrees of freedom. The anisotropy parameter q enters these models as an effective temperature.

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